

PHYSICS 106 (Spring 2004)
EXAM 2 - VERSION A

NAME _____

RECITATION _____

INSTRUCTIONS:

- Please fill in your computer answer sheet filling in the circle on the sheet corresponding to the letters of numbers with a #2 pencil as follows:

In the NAME grid fill in your last name, leave one blank space, then your first name.

Write your ID number in the IDENTIFICATION NUMBER section of the sheet.

Write your recitation section number in the space K,L in the SPECIAL CODES section. The recitation section number should be preceded by a 0 (e.g. section 1 is written as 01).

Fill in the VERSION of this exam on #102 of the answer sheet.

In the next fifty minutes you need to answer all 20 questions for 5 points each. For each question, you should indicate in the answer sheet the best choice. Note that the multiple-choice questions on this exam are numbered 21 through 40. Check your answers carefully, making sure your answers are entered under the correct number, as no changes will be made after the exam is turned in. At the end of the exam you will have to hand in your notes, your exam paper and the answer sheet.

- You are allowed to use one page of handwritten notes and a calculator.

21. A household circuit rated at 120 Volts is protected by a fuse rated at 15 amps. What is the maximum number of 100 Watt light bulbs which can be lit simultaneously in parallel in this circuit without blowing the fuse?
- A. 4
 - B. 8
 - C. 18
 - D. 20
 - E. 24
22. One ampere is equivalent to:
- A. 1 V/m.
 - B. 1 N/C.
 - C. 1 J/s.
 - D. 1 C/s.
 - E. 1 ohm/volt.
23. You have exactly 4 resistors: one $3\ \Omega$, one $4\ \Omega$, one $5\ \Omega$, and one $6\ \Omega$. How can you combine these to make a $2\ \Omega$ resistor? (The symbol Ω stands for "ohm".)
- A. Connect the $3\ \Omega$ resistor in series with the $5\ \Omega$ resistor.
 - B. Connect the $3\ \Omega$ resistor in parallel with the $6\ \Omega$ resistor.
 - C. Connect the $3\ \Omega$ resistor in parallel with the $4\ \Omega$ resistor.
 - D. Connect all four resistors in parallel with each other.
 - E. You can't make a $2\ \Omega$ resistor from the ones listed.
24. Imagine that this classroom contains a constant magnetic field that points from the front to the back. In front of you a negative charge is slowly moving horizontally to your left. As you watch, the magnetic force on the charge
- A. deflects the charge into a clockwise directed vertical circle.
 - B. deflects the charge toward you.
 - C. has no effect on the charge.
 - D. deflects the charge into a counterclockwise vertical circle.
 - E. deflects the charge away from you.

25. Two equal positive charges are near each other. If we increase the amount of charge on just one of them, then
- A. both charges feel an increased electrical force.
 - B. only smaller charge feels an increased electrical force.
 - C. the electric field felt by both charges increases.
 - D. the electric field felt by the smaller charge increases.
 - E. Both answers A and D
26. Comparing the electrostatic force and the gravitational force we can say that
- A. both have the same dependence on distance, both involve attraction and repulsion but the gravitational force is stronger.
 - B. both have the same dependence on distance, both involve attraction and repulsion but the electrostatic force is stronger.
 - C. both have the same dependence on distance, the electrostatic force can be either attractive or repulsive while the gravitational force is only repulsive, and the electrostatic force is weaker.
 - D. both have the same dependence on distance, the electrostatic force can be either attractive or repulsive while the gravitational force is only attractive, and the electrostatic force is stronger.
 - E. the electrostatic force falls off more rapidly with distance, the electrostatic force can be either attractive or repulsive while gravitation is only attractive and the electrostatic force is stronger.
27. A $10\ \mu\text{C}$ charge is at the origin. A $-5\ \mu\text{C}$ charge is on the x-axis 10 cm to the right of the origin. At what point other than at infinity can a $1\ \mu\text{C}$ charge be placed so that there will be no net electrostatic force on it?
- A. At one point between the two charges.
 - B. At one point on the x-axis to the right of the negative charge.
 - C. At one point on the x-axis to the left of positive charge.
 - D. At some point off the x-axis either above or below.
 - E. At no point.

28. The gauge pressure in the tires of a car is 200 kPa. The area of each tire in contact with the road is 120 cm^2 . What is the mass of the car in kg?
- A. 240 kg
 - B. 480 kg
 - C. 960 kg
 - D. 1200 kg
 - E. 1480 kg
29. A gas originally occupies a volume of 0.5 m^3 at a pressure of 100 kPa. It is slowly allowed to expand until the volume is 2.5 m^3 . Assuming the temperature is kept constant, the final pressure will be:
- A. 10 kPa.
 - B. 20 kPa.
 - C. 50 kPa.
 - D. 100 kPa.
 - E. 500 kPa.
30. The density of aluminum is 2700 kg/m^3 . An aluminum block has a mass of 0.25 kg. The buoyant force exerted on this block when it is completely submerged in water of density 1000 kg/m^3 is approximately:
- A. 2.4 N.
 - B. 1.2 N.
 - C. 0.91 N.
 - D. 0.093 N.
 - E. $2.45 \times 10^{-3} \text{ N}$.
31. What is the minimum gauge pressure required at the base of the building of height 200 m for water to reach a closed faucet at the top of the building at a gauge pressure of 500 kPa? ($1 \text{ kPa} = 10^3 \text{ Pa}$)
- A. $2.5 \times 10^6 \text{ Pa}$
 - B. $2.0 \times 10^6 \text{ Pa}$
 - C. $1.5 \times 10^6 \text{ Pa}$
 - D. $1.0 \times 10^6 \text{ Pa}$
 - E. $0.5 \times 10^6 \text{ Pa}$
32. Two current-carrying wires are parallel to one another and separated by 1 cm. If the

distance between them is increased to 2 cm the new force will be what factor times the original force?

- A. 4
- B. 2
- C. 1
- D. $\frac{1}{2}$
- E. $\frac{1}{4}$

33. A transformer has 200 turns on the primary and 20 turns on the secondary. The primary is connected to a direct current source of 100 millivolts. The voltage in the secondary coil will be

- A. 10 millivolts.
- B. 20 millivolts.
- C. 1000 millivolts.
- D. 4000 millivolts.
- E. zero.

34. A transformer is to be used to step up voltage from an alternating current source from 110 V to 660 V. If the primary has 120 turns, then the number of turns in the secondary is

- A. 20.
- B. 660.
- C. 720.
- D. 4320.
- E. 6600.

35. A little magnetic compass has a needle whose tips are clearly labeled N and S. The compass is placed next to a single circular loop of wire lying flat on a wooden table. The current in the loop is clockwise. What happens?
- A. The N tip of the needle is attracted towards the loop.
 - B. The S tip of the needle is attracted towards the loop.
 - C. The needle orients itself with the N tip pointing in the direction of the current in the segment of the loop closest to the needle.
 - D. The needle orients itself with the S tip pointing in the direction of the current in the segment of the loop closest to the needle.
 - E. None of these.
36. Two identical coils of wire are placed on a single horizontal wooden broom handle. The coils are separated by a few centimeters. We now run identical currents in the same direction through each coil. The coils experience
- A. no forces because the currents are identical.
 - B. an attractive magnetic force.
 - C. a repulsive magnetic force.
 - D. an attractive electrostatic force because one coil is negatively charged and the other positively charged.
 - E. a repulsive electrostatic force because both coils are identically charged.
37. A horizontal straight wire carries a current from south to north. The resulting magnetic field lines are
- A. parallel to the wire from south to north.
 - B. parallel to the wire from north to south.
 - C. closed circles perpendicular to the wire directed clockwise as viewed from the south.
 - D. closed circles perpendicular to the wire directed counterclockwise as viewed from the south.
 - E. straight lines perpendicular to the wire.

38. Which of the following temperatures is the lowest?
- A. 0°C
 - B. 0°F
 - C. 263 K
 - D. All are the same
39. Four samples of steel, lead, alcohol and glass all have the same mass and are all initially at 20°C . After 100 calories of heat is added to each sample, the final temperatures are 38.2°C for the steel, 85.6°C for the lead, 23.4°C for the alcohol, and 30°C for the glass. Which of these four materials has the largest specific heat capacity?
- A. The steel.
 - B. The lead.
 - C. The alcohol.
 - D. The glass.
 - E. All have same heat capacity, since all absorbed 100 cal of heat.
40. An ice cube of mass 100 g and at 0°C is dropped into a Styrofoam cup containing 200 g of water at 25°C . The heat of fusion of ice is 80 cal/g and the specific heat capacity of water is $1.0\text{ cal/g }^{\circ}\text{C}$. Assuming the cup doesn't exchange any heat, the final temperature of the system will be which of the following?
- A. -10°C .
 - B. 0°C .
 - C. $+2.5^{\circ}\text{C}$.
 - D. $+5.0^{\circ}\text{C}$.
 - E. $+10^{\circ}\text{C}$.